



Horizon Project

NMC Horizon Project Short List

2012 K-12 Edition

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Time-to-Adoption: One Year or Less

Cloud Computing

Cloud computing first appeared on the near-term horizon in the *NMC Horizon Report: 2009 Higher Education Edition*. Since then, its use for supporting collaboration, file storage, and access to computing cycles, and the number of available applications that rely on cloud technologies have grown every year to the point that few schools do not make some use of the cloud, whether as a matter of policy or not. Cloud computing has become the unifying factor among content and applications on the many devices people use in everyday life. Whether connecting at home, work, school, on the road, or in social spaces, nearly everyone who uses the network relies on cloud computing to access their information and applications. The ability to access services and files from any location and on any device offers considerable promise for extending learning beyond the boundaries of the school day.

Relevance for Teaching, Learning, or Creative Inquiry

- Dynamic provisioning services offered by cloud providers like Amazon's S3 have transformed how we add storage and processing power, and scale resources.
- Cloud computing is being used in computer science programs to simulate virtually any computer, from historical machines to super computers.
- Cloud-based services include a wide range of increasingly powerful tools for almost any platform a user might choose, or any task a user might need to do.

Cloud Computing in Practice

- LearnBoost is a classroom management platform run through the cloud that enables K-12 teachers to track student grades and progress, create standards-aligned lesson plans, and generate analytics and reports, with Google App integration: <http://www.learnboost.com>.
- Schools in Brazil are collaborating on a blog for the Global Curriculum Project, where students participate in a virtual exchange program with schools across five different countries: <http://curriculoglobal.colband.blog.br/>.
- A sixth grade class at Yokohama International School in Japan is using Google Apps to complete all of their assignments, including the creation of tutorials designed in Presentation and surveys created in Forms: <http://blogs.yis.ac.jp/mstech/>.

For Further Reading

Cloud Computing and the K-12 Crowd

http://www.k-12techdecisions.com/article/educators_turning_to_cloud_computing

(D. Craig MacCormack, *K-12 Tech Decisions*, 1 December 2011.) Cloud Internet technology services and unified communications solutions are becoming more popular for schools because it is cost-effective to outsource IT.

K-12 Budgets Begin Shift Toward Cloud

<http://thejournal.com/articles/2011/05/26/k12-budgets-begin-shift-toward-cloud.aspx>

(David Nagel, *The Journal*, 26 May 2011.) This article outlines the "CDW-G 2011 Cloud Computing Tracking Poll" results obtained from polling K-12 institutions and organizations on the benefits and challenges of cloud adoption.

'Personal Cloud' to Replace PC by 2014, Says Gartner

<http://www.gartner.com/it/page.jsp?id=1947315>

(Gartner Newsroom, 12 March 2012.) Gartner analysts have predicted that cloud services will bring a variety of mobile devices to be just as prominent tools as the personal PC because the "personal cloud" allows flexibility in which device is used to access the cloud's information.

Time-to-Adoption: One Year or Less

Collaborative Environments

Collaborative environments are online spaces — often cloud-based — where the focus is making it easy to collaborate and work in groups, no matter where the participants may be. As the typical educator's network of contacts has grown to include colleagues who might live and work across the country, or indeed anywhere on the globe, it has become common for people who are not physically located near each other to collaborate on projects. In classrooms as well, joint projects with students at other schools or in other countries are more and more commonplace as strategies to expose learners to a variety of perspectives. The essential attribute of the technologies in this set is that they make it easy for people to share interests and ideas and easily monitor collective progress. These tools are compelling and widely adopted because they are not only easy to use, but they are also either very low cost or free, and easily available via a web browser.

Relevance for Teaching, Learning, Research, or Creative Inquiry

- Collaborative environments are an efficient way for students to work together, whether the groups are composed of students in the same physical class or not.
- A class or project group can assemble a collaborative workspace very quickly using widgets that pull information from a range of sources.
- Large-scale collaborative environments can facilitate an almost spontaneous development of communities of people who share similar interests.

Collaborative Environments in Practice

- The BadgeStack Project is a collaborative platform that certifies and recognizes informal learning that happens in communities, after school programs, and museums: <http://badgestackproject.org/>.
- The Flat Classroom Project joins together middle and high school students to collaborate virtually on assignments with real world relevance: <http://www.flatclassroomproject.org/>.
- The international eLanguages project facilitates collaboration between teachers and classrooms around the world. Teachers can select or propose projects for their classes to take part in, exchange ideas with other teachers, and share resources: <http://www.elanguages.org>.

For Further Reading

Collaboration as an Intangible Asset

http://blogs.hbr.org/cs/2011/06/collaboration_as_an_intangible.html

(Robert J. Thomas, *Harvard Business Review*, 16 June 2011.) The author explores social network analysis as a way to discover patterns of interactions and collaboration, which has clear applications for educators evaluating student use of collaborative environments.

Collaborative Learning Environments Sourcebook

<http://www.criticalmethods.org/collab/>

(CriticalMethods.org, accessed 21 November 2011.) This site offers detailed guides and resources for everything from different types of collaboration tools to building communities of practice and e-portfolios.

Time-to-Adoption: One Year or Less

Mobiles and Apps

Mobile phones — distinct from new sorts of larger format mobile devices such as tablets — have as a category proven more interesting and more capable with each passing year. Smartphones including the iPhone and Android have redefined what we mean by mobile computing, and in the past three to four years, the small, often simple, low cost software extensions to these devices — apps — have become a hotbed of development. New tools are free or sell for as little as 99 cents. A popular app can see millions of downloads in a short time, and that potential market has spawned a flood of creativity that is instantly apparent in the extensive collections available in the app stores. Apple's app store recently passed 25 billion downloads — with 10 billion in just the last eight months — and simple but useful apps have found their way into almost every form of human endeavor. The power of apps, coupled with the portability of mobile devices, is causing many schools to take another look at their policies regarding mobile devices. Many see mobiles as a key aspect of Bring Your Own Device (BYOD) environments.

Relevance for Teaching, Learning, or Creative Inquiry

- The BYOD model allows students to make use of the mobiles they are already comfortable with outside of class to both enhance in-class learning experiences and extend learning beyond the school day.
- Mobiles enable 24/7 3 or 4G-based Internet access and are a more cost-effective, flexible solution than desktops and laptops for which schools support the cost of bandwidth.
- As interactive and social features become more integrated into mobile apps, learners can share their findings on topics, making the app an ever-growing repository of information.

Mobiles and Apps in Practice

- At a Swiss primary school, 5th grade students are equipped with smartphones and allowed to use the Internet services at no charge: <http://www.projektschule-goldau.ch>.
- The Elements iPad app enables students to rotate 3D periodic table element images 360 degrees for a more immersive experience: <http://www.youtube.com/watch?v=nHiEqf5wb3g>.
- Rock Hill School in South Carolina is piloting a BYOD program: <http://www.zdnet.com/blog/igeneration/school-considers-byod-phone-use-in-class/15583>.

For Further Reading

7 Myths About BYOD Debunked

<http://thejournal.com/articles/2011/11/09/7-byod-myths.aspx>

(Lisa Neilsen, *The Journal*, 9 November 2011.) BYOD has become a controversial subject, and this article confronts the current concerns, including the distraction factor, and dispels them.

How Mobile Apps Are Changing Classrooms and Education

http://www.huffingtonpost.com/piyush-mangukiya/mobile-apps-education_b_1250582.html

(Piyush Mangukiya, *Huffington Post*, 3 February 2012.) This article gives examples of mobile apps used in the classroom that have increased student participation and engagement.

In Some Cash-Strapped Schools, Kids Bring Their Own Tech Devices

<http://mindshift.kqed.org/2012/02/in-cash-strapped-schools-kids-bring-their-own-tech-devices/>

(Tina Barseghian, *Mind Shift*, 3 February 2012.) This article addresses the pros and cons of the BYOD movement in schools.

Time-to-Adoption: One Year or Less

Tablet Computing

In the past year, advances in tablets have captured the imagination of educators around the world. Led by the incredible success of the iPad, which in 2011-12 was selling at the rate of more than 3 million units a month, other similar devices such as the Samsung Galaxy and Sony's Tablet S have also begun to enter this rapidly growing new market. In the process, the tablet (a form that is distinct from tablet PCs) have come to be viewed as not just a new category of mobile devices, but indeed a new technology in its own right, one that blends features of laptops, smartphones, and earlier tablet computers with always-connected Internet, and thousands of apps with which to personalize the experience. As these new devices have become more used and understood, it is clear that they are independent and distinct from other mobile devices such as smartphones, eReaders, or tablet PCs. With significantly larger screens and richer gesture-based interfaces than their smartphone predecessors, they are ideal tools for sharing content, videos, images, and presentations because they are easy for anyone to use, visually compelling, and highly portable.

Relevance for Teaching, Learning, or Creative Inquiry

- As a one-to-one solution, tablets present an economical, flexible alternative to laptops and desktops due to their lower cost, greater portability, and access to apps.
- Tablets are conducive to engaging in learning outside the classroom, with a suite of tools for capturing data in real-time and collaborating on projects.
- Tablets are easily adaptable to almost any learning environment, with tens of thousands of educational applications emerging as part of a new software distribution model.

Tablet Computing in Practice

- As part of their Challenge Based Learning project, 5th and 6th grade students at Ringwood North Primary School used one-to-one iPad devices on tasks related to helping communities recover from natural disasters: <http://vimeo.com/applesforkids/resilience>.
- The Eanes Independent School District in Texas embarked on an iPad pilot program, exploring how to best incorporate the iPad into instruction and across various disciplines: <http://eaneswifi.blogspot.com/>
- In South Africa, the iPad is helping autistic students with their communication skills: <http://www.smsweb.co.za/ipad-a-boon-for-autistic-kids/>.

For Further Reading

\$81 Tablets for All Thai First Grade Students

<http://www.futuregov.asia/articles/2012/mar/06/thailand-sign-900000-tablet-pc-contract-china-firm/>
(Thanya Kunakornpaiboonsiri, *Asia Pacific Future Gov*, 6 March 2012.) Under the "One Tablet PC Per Child" initiative, 900,000 tablets will be supplied to first grade students in Thailand's government schools.

iPads: What are We Learning? (PDF)

<http://education.alberta.ca/media/6673630/ipads%20report%202012-03-02.pdf>
(Government of Alberta, 3 October 2011.) Alberta Education hosted an event for school authorities that are exploring the use of iPads in schools, which resulted in a report that covers subjects including student engagement and enhanced student assessment.

Math That Moves: Schools Embrace the iPad

<http://www.nytimes.com/2011/01/05/education/05tablets.html?pagewanted=all>
(Winnie Hu, *The New York Times*, 4 January 2011.) The iPad is being used to expand learning outside of the classroom, and this article addresses its impact.

Time-to-Adoption: Two to Three Years

Digital Identity

Digital identity management focuses on enabling users to create a single digital identity that can be used in any place where a log-in is required to access a website or service. It is not a single technology, but a group of related technologies and ideas. In the simplest terms, one's digital identity is a method that allows recognition any place where a log-in is needed. A variety of different systems are being developed, and though they have the same broad purpose of creating a sign-on system that is convenient and secure for an individual rather than a company or organization, ideas about what precisely defines a user-centric identity system and how that would be implemented are still widely varied. Both Google and Facebook are positioning their systems to be the "home" of one's digital identity.

Relevance for Teaching, Learning, or Creative Inquiry

- Digital identity allows for broader control beyond information systems; there is one path to trace when profiling an individual's digital footprint, i.e. content delivery.
- Digital identity has the potential to personalize curriculum through profiling learners' interests based on their historic content consumption.
- A single ID and password helps educators and students seamlessly connect to resources across multiple devices and websites.

Digital Identity in Practice

- The Future of Identity in the Information Society is an organization dedicated to studying and documenting the forensic applications, privacy, mobility, and evolving definition of digital identity: <http://www.fidis.net/>.
- Gravatar offers a way for users to personalize their digital identity with an avatar that is associated with their user ID anywhere that person posts online: <http://en.gravatar.com/>.
- OpenID is a single identity solution that provides users with a single, more secure way to log onto web pages without having to remember passwords or fill out registration forms: <http://openid.net/>

For Further Reading

The Challenge of Creating Web-Based Identity Standards

<http://mashable.com/2011/11/14/google-consumer-authentication/>

(John Fontana, *Mashable*, 14 November 2011.) The author discusses the battle between corporations, including Google, Facebook, and Yahoo, to own users' digital identities, as well as the security implications.

In Pursuit of a Single Identity, Online and Off

<http://www.smartplanet.com/blog/smart-takes/in-pursuit-of-a-single-identity-online-and-off/22526>

(Andrew Nusca, 6 February 2012.) Researchers at the University of Southampton are conducting a three-year study focused on a "super-identity," which is a single, final ID.

Single Sign-On, Multiple Benefits (PDF)

<http://www.cosn.org/Portals/7/docs/Publications/CoSNK-12ID5-15.pdf>

(CoSN, 24 May 2011.). The CoSN Technical Committee wrote this white paper to address the federated identity management in the K-12 sector and the unique access management challenges, including the development of legal agreements and policies.

Time-to-Adoption: Two to Three Years

Game-Based Learning

Game-based learning has gained considerable traction since 2003, when James Gee began to describe the impact of game play on cognitive development. Since then, research — and interest in — the potential of gaming on learning has exploded, as has the diversity of games themselves, with the emergence of serious games as a genre, the proliferation of gaming platforms, and the evolution of games on mobile devices. Developers and researchers are working in every area of game-based learning, including games that are goal-oriented; social game environments; non-digital games that are easy to construct and play; games developed expressly for education; and commercial games that lend themselves to refining team and group skills. Role-playing, collaborative problem solving, and other forms of simulated experiences are recognized for having broad applicability across a wide range of disciplines.

Relevance for Teaching, Learning, or Creative Inquiry

- Educational games offer opportunities for both discovery-based and goal-oriented learning, and can be very effective ways to develop teambuilding skills.
- Simulations and role-playing games allow students to re-enact difficult situations to try new responses or pose creative solutions.
- Educational games can be used to teach cross-curricular concepts that touch on many subjects in an engaging way.

Game-Based Learning in Practice

- EVOKE is a social networking game that simulates real global issues to empower people to find new and innovative solutions: <http://www.urgentevoke.com/>.
- Globaloria is a social learning network for teaching children ages 10 and up how to create educational webgames and interactive simulations: <http://www.globaloria.org>.
- The Learning Games Network Design Corps project is enabling students to become game designers by equipping them with training and game design toolkits: http://www.learninggamesnetwork.org/index.php?/projects/current_projects/kentucky_design_corps/general.

For Further Reading

Extended Interview: Dr. James Gee (Video)

<http://video.pbs.org/video/1767377460>

(PBS, 13 February 2011.) In this interview with educational gaming expert James Gee, he discusses how gaming environments stimulate advanced problem-solving and innovation.

Kids and Video Games: Why Children Should Play More

<http://venturebeat.com/2012/03/13/kids-and-video-games-why-children-should-play-more/>

(Scott Steinberg, *Venture Beat*, 13 March 2012.) This article highlights aspects of gaming, such as interactivity and creativity. Many gaming scenarios require strategic thinking, interpretative analysis, plan formulation, and ability to respond to change.

When Gaming Is Good for You

http://online.wsj.com/article/SB10001424052970203458604577263273943183932.html?mod=ITP_personaljournal_0

(Robert Lee Hotz, *Wall Street Journal*, 5 March 2012.) This article examines what research has revealed so far on gameplay and its positive and negative effects on the brain and cognitive functions. Notably, concentration coupled with the brain's reward-related neurotransmitters like dopamine strengthens neural circuits, much like exercise for muscles.

Time-to-Adoption: Two to Three Years

Learning Analytics

Learning analytics refers to the interpretation of a wide range of data produced by and gathered on behalf of students to assess academic progress, predict future performance, and spot potential issues. Data are collected from explicit student actions, such as completing assignments and taking exams, and from tacit actions, including online social interactions, extracurricular activities, posts on discussion forums, and other activities that are not typically viewed as part of a student's work. The goal of learning analytics is to enable teachers and schools to tailor educational opportunities to each student's level of need and ability. Learning analytics promises to harness the power of advances in data mining, interpretation, and modeling to improve understanding of teaching and learning, and to tailor education to individual students more effectively. Still in its very early stages, and not yet at the stage where it is practical to talk about implementation in schools, learning analytics is an emerging scientific practice that hopes to redefine what we know about learning by mining the vast amount of data produced by students in academic activities.

Relevance for Teaching, Learning, or Creative Inquiry

- The promise of learning analytics is that when correctly applied and interpreted, it will enable teachers to more precisely identify students' learning needs and tailor instruction appropriately.
- If used effectively, learning analytics can help surface early signals that indicate a student is struggling, allowing teachers and schools to address issues quickly.

Learning Analytics in Practice

- The mobile app GoSoapBox allows students to anonymously ask questions, participate in discussions, or tell the teacher if they're confused via smartphone, tablet device, or laptop: <http://gosoapbox.com/>.
- Rancocas Valley Regional High School in New Jersey is collecting real-time feedback of standards-based declarative and procedural knowledge: <http://www.rvhpggrant.org>.
- Socrative is a student response system that enables teachers to assess student learning through the use of any mobile device and adjust their teaching approach in real-time: <http://www.socrative.com/>.

For Further Reading

How Data and Analytics Can Improve Education

<http://www.webcitation.org/getfile.php?fileid=ce68cbe084978b008999a15a746ff385fae1a3ea>

(Audrey Watters, O'Reilly Radar, 25 July 2011.) This interview with education theorist George Siemens addresses the importance and consequences of privacy issues within learning analytics.

Learning Analytics: The Coming Third Wave

<http://net.educause.edu/ir/library/pdf/ELIB1101.pdf>

(Malcolm Brown, EDUCAUSE Learning Initiative, April 2011.) This article discusses the current position of learning analytics in education, and how third party applications are beginning to make the tools more cost-effective. It also addresses the ethics involved in deploying learning analytics platforms.

What are Learning Analytics?

<http://www.elearnspace.org/blog/2010/08/25/what-are-learning-analytics/>

(George Siemens, eLearnSpace, 25 August 2010.) This article presents an overview of learning analytics and discusses how it might be applied in learning institutions.

Time-to-Adoption: Two to Three Years

Personal Learning Environments

Personal learning environments (PLEs) are described as ways to support self-directed and group-based learning, designed around each user's goals, with great capacity for flexibility and customization. PLEs are conceived as drawing on a variety of discrete tools, often chosen by the learner, which can be connected or used in concert in a transparent way. Using a growing set of free and simple tools and applications, such as a collection of apps on a tablet, it is already quite easy to support one's social, professional, learning and other activities. While the concept of PLEs is still fairly fluid, it does seem to be clear that a PLE is not simply a technology but an approach or process that is individualized by design, and thus different from person to person. Widespread adoption of PLEs may require shifts in policy, as well as attitudes, toward technology for teaching, and learning.

Relevance for Teaching, Learning, or Creative Inquiry

- PLEs may cater to students with differing learning styles; for instance, visual learners might be able to obtain material from a different source than auditory learners do.
- Students using PLEs may benefit from the practice of keeping track of, and curating, their own resource collections.
- The notion of a PLE is a useful way for students to think about the collections of apps they might assemble on a smartphone or tablet to help them support their learning and learning-related work.

Personal Learning Environments in Practice

- Innovative Technologies for an Engaging Classroom is a pan-European project dedicated to designing the future classroom by bringing together policy-makers, researchers, technology suppliers, and teachers to develop scalable learning environments for students: <http://itec.eun.org>.
- MindTap works as a personal learning experience, building on concepts used in PLEs. This system offers adaptable learning paths and activities that instructors can choose from based on student needs: <http://www.cengagesites.com/academic/?site=5232>.

For Further Reading

A Place to Call our Own: Personal, Online Learning Spaces through ePortfolios

<http://elearnmag.acm.org/archive.cfm?aid=2141511>

(Allison Miller, *eLearn Magazine*, February 2012.) The author explores one possible outcome of personal learning environments — ePortfolios — which are resources that allow teachers to monitor individual student progress and enable students to easily share their body of work.

Preparing Students to Learn Without Us

<http://www.ascd.org/publications/educational-leadership/feb12/vol69/num05/Preparing-Students-to-Learn-Without-Us.aspx>

(Will Richardson, *ASCD Educational Leadership*, Volume 69, February 2012.) This article discusses how teachers can help K-12 students learn about the subjects that genuinely interest them through personal learning environments.

This Time It's Personal

<http://thejournal.com/articles/2012/01/04/personalized-learning.aspx>

(Jennifer Demski, *The Journal*, 4 January 2012.) This article emphasizes the crucial role of a solid technology infrastructure in fostering a more student-centered classroom.

Time-to-Adoption: Four to Five Years

Augmented Reality

Augmented reality (AR), a capability that has been around for decades, is shifting from what was once seen as a gimmick to a tool with tremendous potential. The layering of information over 3D space produces a new experience of the world, sometimes referred to as “blended reality,” and is fueling the broader migration of computing from the desktop to the mobile device, bringing with it new expectations regarding access to information and new opportunities for learning. While the most prevalent uses of augmented reality so far have been in the consumer sector (for marketing, social engagement, amusement, or location-based information), new uses seem to emerge almost daily, as tools for creating new applications become even easier to use. A key characteristic of augmented reality is its ability to respond to user input. This interactivity confers significant potential for learning and assessment; with it, students can construct new understanding based on interactions with virtual objects that bring underlying data to life. Dynamic processes, extensive datasets, and objects too large or too small to be manipulated can be brought into a student’s personal space at a scale and in a form easy to understand and work with.

Relevance for Teaching, Learning, or Creative Inquiry

- Augmented reality has strong potential to provide both powerful contextual, *in situ* learning experiences and serendipitous exploration and discovery of the connected nature of information in the real world.
- Students visiting historic sites can access AR applications that overlay maps and information about how the location looked at different points of history.
- Games that are based in the real world and augmented with networked data can give educators powerful new ways to show relationships and connections.

Augmented Reality in Practice

- LearnAR is a new augmented reality resource that makes use of a digital, video, or web camera to display virtual content layered over real world content: <http://learnar.org/index.html>.
- This wiki was launched to explore the applications of augmented reality for special education, specifically for deaf and blind students:
<http://wildcataz.wikispaces.com/Augmented+Reality+for+Special+Education>

For Further Reading

21st Century Lessons with Mobile Augmented Reality (Video)

<http://www.youtube.com/watch?v=F0D7G8R6PjM>

(K12 Mobile Learning, 26 May 2011.) This brief video demonstrates how teachers’ lessons and classroom resources can be more engaging when augmented reality is integrated.

Google Sees a Bright Future in Smart Shades

<http://www.technewsworld.com/story/74486.html>

(Richard Adhikari, *Tech News World*, 22 February 2012.) Google is developing eyeglasses that reveal information to the user through an embedded screen. This article covers the key details of this new product while exploring competing models.

TEDxYouth: Marko Todorovic on AR

<http://tedxtalks.ted.com/video/TEDxYouthISB-Marko-Todorovic-Au>

(Marko Todorovic, TED, 8 December 2011.) Marko Todorovic of Live View Studio discusses the benefits and applications of augmented reality among youth.

Time-to-Adoption: Four to Five Years

Natural User Interfaces

It is already common to interact with a new class of devices entirely by using natural movements and gestures. The Microsoft Surface, iPad, iPhone and iPod Touch, the Nintendo Wii, and other natural user interfaces accept input in the form of taps, swipes, and other ways of touching, hand and arm motions, or body movement. These are the first in a growing array of alternative input devices that allow computers to recognize and interpret natural physical gestures as a means of control. Natural user interfaces allow users to engage in virtual activities with movements similar to what they would use in the real world, manipulating content intuitively. The idea of being able to have a completely natural interaction with your device is not new, but neither has its full potential been realized. In previous years, the *NMC Horizon Report* has documented two major development paths for natural user interfaces: marker-based and markerless. While both pathways continue to see development, what makes natural user interfaces interesting now is the increasingly high fidelity of systems that understand gestures and their nuances, as well as the convergence of gesture-sensing technology with voice recognition, which allows for both gesture and voice to communicate the user's intentions to devices.

Relevance for Teaching, Learning, or Creative Inquiry

- Natural user interfaces allow users to easily perform precise manipulations that can be difficult to manage with a mouse or controller.
- Natural user interfaces facilitate the convergence of a user's thoughts with their movements and voice, which appeals to kinetic learners who learn by acting.
- Natural user interfaces help blind, dyslexic, or otherwise disabled students, reducing their dependence on keyboards.

Natural User Interfaces in Practice

- The EyeMusic project uses eye-tracking sensors to compose multimedia productions based on the user's eye movements: <http://www.cs.uoregon.edu/Research/cm-hci/EyeMusic/>.
- Microsoft is developing a wearable multi-touch projector that will enable teachers and students to interact with a projected interface: <http://www.fractuslearning.com/2012/03/12/roboteacher-wearable-multitouch-projector/>.

For Further Reading

Gesture Recognition Moves Beyond Gaming

<http://www.softwarequalityconnection.com/2011/05/gesture-recognition-moves-beyond-gaming/>

(Steve Sechrist, Software Quality Connection, 23 May 2011.) In the context of the major developments in gesture recognition, the author discusses the potential for Kinect-style natural user interfaces.

LG adds Google TVs, Smart TVs get Voice and Gesture Control

<http://news.consumerreports.org/electronics/2012/01/ces-2012-lg-adds-google-tvs-updates-smart-tv-with-face-recognition.html>

(James K. Willcox, *Consumer Reports*, 9 January 2012.) LG Electronics is releasing televisions that have voice and gesture control, and built-in Wi-Fi to beam content like music, photos, and videos from a notebook to the television set.

Using Kinect to Engage Students

<http://senai-educationaltechnologies.blogspot.com/2011/12/using-kinect-to-engage-students.html>

(SENSAI – Education Technologies, 27 December 2011.) This post contains a series of videos and offers an introduction to integrating Kinect into classroom activities.

Time-to-Adoption: Four to Five Years

Semantic Applications

Semantic-aware applications infer the meaning, or semantics, of information on the Internet to make connections and provide answers that would otherwise entail a great deal of time and effort. New applications use the context of information as well as the content to make determinations about relationships between bits of data; examples such as Triplt, SemaPlover, and Xobni organize information about travel plans, places, or email contacts and display it in convenient formats based on semantic connections. Semantic searching is being applied to scientific inquiries, allowing researchers to find relevant information without having to deal with apparently similar, but irrelevant, information. Semantic applications have the potential to be immensely powerful educational resources that enable students to more effectively sift, query, and gather relevant information. To maximize their potential, semantic applications can be used in conjunction with federated content repositories or open institutions.

EDITOR'S NOTE: A detailed review of the literature has found almost no current activity in this area that has direct implications for K-12, as well as a dearth of practical examples for primary and secondary schools.

Relevance for Teaching, Learning, or Creative Inquiry

- Semantic portals that intelligently aggregate information from a variety of sources would facilitate student research in many practical and useful ways.
- Fully-developed semantic search tools will be able to return results from a topical search with video, images, text, and other content aggregated and presented in ways that reveal their subtle relationships and similarities.
- As the amount of available information continues to grow at a geometric pace, semantic tools that can deliver context-sensitive information will become more key for scholarship, research and sense-making.

Semantic Applications in Practice

- Siri is a virtual personal assistant for mobiles that features voice recognition and allows users to request time- and location-sensitive resource recommendations: <http://siri.com>.
- TrueKnowledge is a UK-founded smart Internet search engine that combines natural language analysis with internal and external databases to answer specific questions instantly, rather than redirecting to a list of web pages: <http://www.trueknowledge.com>.
- Wolfram Alpha is a knowledge engine that enables students to conduct quick searches to get homework help, perform unit conversions, and more: <http://www.wolframalpha.com/>.

For Further Reading

Learning in the Semantic Web

<http://elearnmag.acm.org/archive.cfm?aid=2167476>

(Reuben Tozman, *eLearn Magazine*, March 2012.) This article discusses how the semantic web facilitates more personalized learning experiences as many online resources can now do the content search and organization work for us while keeping track of user preferences.

Yves Raimond on the BBC's Interlinked, Semantic Web of the Future

<http://www.guardian.co.uk/media/pda/2011/apr/06/bbc-yves-raimond>

(The Guardian, 6 April 2011.) This article chronicles new improvements in line for the BBC technical infrastructure, including better navigation between program pages, the coverage and consistency of news feeds, and deploying external developers to build applications to delve into existing program data.

Time-to-Adoption: Four to Five Years

Tools for Assessing 21st Century Learning Skills

The challenge of assessing 21st Century Learning Skills is that tools to assess the more subtle but increasingly important indicators of learning and development that are showcased through classroom activities, group work, and all sorts of informal exercises are few, and those that do exist are highly subjective. Rubrics are helpful but require extensive involvement from the teacher to accurately and quickly interpret patterns in student behavior. What distinguishes this topic from the broader topic of learning analytics is the focus on a very specific type of behaviors that is not necessarily based on a student demonstrating knowledge and subject competency, but instead skill development. While an interesting notion, this idea may be ahead of its time in regards to adoption on school campuses.

EDITOR'S NOTE: A detailed review of the literature found almost no research in this area, and a paucity of examples or demonstration projects related to practical assessment of 21st Century Skills.

Relevance for Teaching, Learning, or Creative Inquiry

- Tools that assess 21st Century Learning Skills could synthesize information about a student's performance and behaviours and provide analysis of his or her skill level.
- 21st Century Skills Assessment tools could shift the emphasis from tests to more realistic indicators of skill acquisition often evidenced in more informal learning activities and settings.
- Assessments of 21st Century Skills could provide universities, colleges, and workplaces with a more accurate and relevant depiction of a student's abilities and character.

Tools for Assessing 21st Century Learning Skills in Practice

- ATC21S is a research project in Melbourne, Australia that is exploring ways of assessing 21st Century Skills and adopting them in the classroom: <http://atc21s.org/>.
- Learning.com's 21st Century Skills Assessment provides tools and services for evaluating student skill acquisition: <http://www.learning.com/21st-century-skills-assessment/>.

For Further Reading

Assessment of 21st Century Skills (PDF)

<http://www.p21.org/storage/documents/Assessment092806.pdf>

(Partnership for 21st Century Skills, 28 September 2006.) The Partnership for 21st Century Skills is dedicated to helping learners gain key skills that relate to real world needs. This PDF provides an overview of those skills and how they can be assessed.

Educational Assessment Technology Standards

<http://www.ed.gov/oii-news/educational-assessment-technology-standards>

(US Department of Education, 17 October 2011.) This article and accompanying draft document outline the need for standard technology infrastructures for learning assessments.

Putting our Ideas of Assessment to the Test

<http://www.eschoolnews.com/2010/09/27/putting-our-ideas-of-assessment-to-the-test/?ast=18&astc=118>

(eSchool News, October 2010.) This article focuses on the current United States economic recession as a catalyst for encouraging assessment of more relevant skills in schools.

Key Trends

The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators. Institutions must consider the unique value that each adds to a world in which information is everywhere. In such a world, sense-making and the ability to assess the credibility of information are paramount. Mentoring and preparing students for the world in which they will live is again at the forefront. K-12 institutions have always been seen as critical paths to educational credentialing, but challenges from competing sources are redefining what these paths can look like.

As the cost of technology drops and school districts revise and open up their access policies, it is becoming increasingly common for students to bring their own mobile devices. Many schools are launching BYOD programs so that students can use the devices they already have as learning tools within a traditional classroom setting in addition to informal and out-of-school environments. This is happening partly because of how BYOD impacts budgets; schools can spend less money on technology if students use their own, which frees up the school-supplied technology for students who cannot afford to buy devices. In turn, schools do not need to purchase and maintain a large amount of hardware. The surge of BYOD in K-12 can also be attributed to an attitude shift as schools are beginning to embrace the use of mobiles both in and outside of the classroom as an engaging way to learn.

Education paradigms are shifting to include online learning, hybrid learning and collaborative models. Budget cuts have forced institutions to re-evaluate their education platforms and find alternatives to the exclusive face-to-face learning models. As such, what once was seen as a challenge has now become an increasingly interesting trend. Students already spend much of their free time on the Internet, learning and exchanging new information through various resources, including social networks. Institutions that embrace face-to-face/online hybrid learning models have the potential to leverage the online skills learners have already developed independent of academia. We are beginning to see developments in online learning that offer similar — if not better — environments than physical campuses, including opportunities for increased collaboration while equipping students with stronger digital skills. Hybrid models, when designed and implemented successfully, enable students to learn at their own pace and style, whenever they want from wherever they are.

One-to-one computing is spreading to a large number of countries and regions. Providing students constant access to computers and the Internet is an education game-changer. Current studies have been tracking and analyzing the ways in which one-to-one computing is impacting student achievement in class, and the early results are promising. A key driver behind the adoption of this model is how well it complements both project- and challenge-based learning, which already have proven correlations to increasing student engagement.

People expect to be able to work, learn, and study whenever and wherever they want to. Life in an increasingly busy world where learners must balance demands from home, work, school, and family poses a host of logistical challenges with which today's ever more mobile students must cope. A faster approach is often perceived as a better approach, and as such people want easy and timely access not only to the information on the network, but to their social networks that can help them to interpret it and maximize its value. The implications for informal learning are profound, as are the notions of "just-in-time" learning and "found" learning, both ways of maximizing the impact of learning by ensuring it is timely and efficient.

Technology continues to profoundly affect the way we work, collaborate, communicate, and succeed. Increasingly, technology skills are critical to success in almost every arena, and those who are more facile with technology will advance while those without access or skills will not. The digital divide, once seen as a factor of wealth, is now seen as a factor of education: those who have the opportunity to learn technology skills are in a better position to obtain and make use of technology than those who do not. Evolving occupations, multiple careers, and an increasingly mobile workforce contribute to this trend.

There is a new emphasis in the classroom on more challenge-based and active learning. Challenge-based learning and similar methods foster more active learning experiences, both inside and outside the classroom. As technologies such as tablets and smartphones now have proven applications in higher education institutions, educators are leveraging these tools, which students already use, to connect the curriculum with real life issues. The active learning approaches are decidedly more student-centered, allowing them to take control of how they engage with a subject and to brainstorm and implement solutions to pressing local and global problems. The hope is that if learners can connect the course material with their own lives and their surrounding communities, then they will become more excited to learn and immerse themselves in the subject matter. Studies of challenge-based learning in practice, including two authored by the NMC, depict an increase in the uptake of 21st Century Skills among learners, including leadership and creativity.

Significant Challenges

The demand for personalized learning is not adequately supported by current technology or practices. The increasing demand for education that is customized to each student's unique needs is driving the development of new technologies that provide more learner choice and control and allow for differentiated instruction, but there remains a gap between the vision and the tools needed to achieve it. It has become clear that one-size-fits-all teaching methods are neither effective nor acceptable for today's diverse students. Technology can and should support individual choices about access to materials and expertise, amount and type of educational content, and methods of teaching.

Digital media literacy continues its rise in importance as a key skill in every discipline and profession. This challenge, driven by a related trend, appears here because despite the widespread agreement on the importance of digital media literacy, training in the supporting skills and techniques is rare in teacher education. As classroom professionals begin to realize that they are limiting their students by not helping them to develop and use digital media literacy skills across the curriculum, the lack of formal training is being offset through professional development or informal learning, but we are far from seeing digital media literacy as a norm. This challenge is exacerbated by the fact that digital literacy is less about tools and more about thinking, and thus skills and standards based on tools and platforms have proven to be somewhat ephemeral.

Economic pressures and new models of education are bringing unprecedented competition to traditional primary and secondary schools. Across the board, institutions are looking for ways to control costs while still providing a high quality of service. Institutions are challenged by the need to support a steady — or growing — number of students with fewer resources and staff than before. As these pressures continue, other models may emerge that diverge from traditional ones. Simply capitalizing on new technology, however, is not enough; the new models must use these tools and services to engage students on a deeper level.

Institutional barriers present formidable challenges to moving forward in a constructive way with emerging technologies. A key challenge is the fundamental structure of the K-12 education establishment — aka “the system.” As long as maintaining the basic elements of the existing system remains the focus of efforts to support education, there will be resistance to any profound change in practice. Learners have increasing opportunities to take their education into their own hands, and options like informal education, online education, and home-based learning are attracting students away from traditional educational settings. If the system is to remain relevant it must adapt, but major change comes hard in education. Too often it is education's own processes and practices that limit broader uptake of new technologies. Much resistance to change is simply comfort with the status quo, but in other cases, such as in promotion and tenure reviews, experimentation or innovative applications of technologies is often seen as outside the role of researcher or scientist.

K-12 must tackle the increased blending of formal and informal learning. Traditional lectures and subsequent testing are still dominant learning vehicles in schools. In order for students to get a well-rounded education with real world experience, they must also engage in more informal in-class activities as well as learning outside the classroom. Schools should encourage students to experiment and take risks without the fear of formal consequences. A new model, called the “flipped classroom,” has students watching teacher-created instructional videos at home, and using class time to collaborate with classmates and problem-solve. Some of the main challenges in this tactic are designing an effective blended learning model and getting buy-in from school administration.

Learning that incorporates real life experiences is not occurring enough and is undervalued when it does take place. This challenge is an important one in K-12 schools, because it results in a lack of engagement in learning on the part of students who are seeking some connection between their own lives and their experience in school. Use of technology tools that are already familiar to students, project-based learning practices that incorporate real-life experiences, and mentoring from community members are a few practices that support increased engagement. Practices like these may help retain students in school and prepare them for further education, careers, and citizenship in a way that traditional practices are failing to do.

Many activities related to learning and education take place outside the walls of the classroom and thus are not part of traditional learning metrics. Students can take advantage of learning material online, through games and programs they may have on systems at home, and through their extensive — and constantly available — social networks. The experiences that happen in and around these venues are difficult to tie back to the classroom, as they tend to happen serendipitously and in response to an immediate need for knowledge, rather than being related to topics currently being studied in school.

Putting 21st century technology into 19th century schools is a major undertaking. The 19th century school systems are still ubiquitous, from the outdated, industrial nature of old buildings to the old learning models and processes upheld therein. Schools must adopt 21st century technology to overcome the challenge of the current linear archetypes. These new tools are the antidote; organic and non-linear, 21st century technology facilitates the freedom for students to quickly discover information whenever they need it. In turn, they develop more sophisticated skill sets that open the doors to two- and four-year universities and better jobs.

We are not using digital media for formative assessment the way we could and should. Assessment is an important driver for educational practice and change, and over the last years we have seen a welcome rise in the use of formative assessment in educational practice. However, there is still an assessment gap in how changes in curricula and new skill demands are implemented in education; schools do not always make necessary adjustments in assessment practices as a consequence of these changes. Another assessment gap is related to the lack of innovative uses of digital media in formative assessment. Many tools are still tied to outdated LMS and do not have the ability to assess critical data sets, such as 21st Century Skills acquisition.

